

INTENSIFICATION OF SMALLHOLDER OIL PALM PLANTATIONS: WHERE DO WE START?

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EXECUTIVE SUMMARY

Highlights

- To meet the projected increase in future global demands for crude palm oil (CPO), Indonesia aims to produce 60 million tonnes per year by 2045 (Septiadi 2016). However, with the current state of national CPO production, Indonesia requires an additional 6.1 million hectares of land for oil palm cultivation. This means that the impact on the environment may also increase.
- Given the high productivity gap between smallholder plantations and companies, the intensified output of smallholder oil palm plantations can potentially be an intermediate solution between the importance of increasing production and preserving the environment.
- Selecting the locations for the intensification program is key to avoiding providing incentives to business actors whose plantations are not suitable for oil palm cultivation and to increase the effectiveness of the use of available resources. This study aims to determine the locations of smallholder oil palm plantations that may be prioritized for the intensification program by considering several aspects, including plantation area, productivity, land suitability, conservation, land legality, and potential market access.

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- Site selection was conducted in several stages: 1) selecting smallholder plantations at the district level that were suitable for oil palm cultivation and outside forest and peat areas, 2) assigning a score to the district based on the calculated proportion of the selected smallholder plantation area and the productivity of smallholder plantations in the district, and 3) selecting smallholder plantations with “high” and “medium” ratings from the scoring results with a map of potential market access areas.
- There are at least 499,399 hectares of smallholder oil palm plantations in 11 provinces and 23 districts in Indonesia that may be prioritized for intensification programs.
- The methodology and results of this study may be utilized by stakeholders implementing the intensification program, in particular the Ministry of Agriculture, the Oil Palm Plantation Fund Management Agency (BPDPKS), and local governments, in planning for oil palm rejuvenation programs, provision of plantation facilities and infrastructure, and the development of oil palm plantation areas.
- Each site and other relevant data must be checked to more accurately select priority locations according to the criteria of each intensification program.

Background

Global consumption of palm oil is increasing by the day. This increase is in part driven by the rising demand for palm oil as a raw material for food, consumer goods, and biofuel production. As the world’s largest producer of palm oil, Indonesia seeks to match the increase in demand by boosting production.

The palm oil industry is often cited as one of the main causes of deforestation in tropical forests. To address the problem of deforestation, in September 2018, the Indonesian government issued a moratorium on the use of forests for oil palm plantations. Intensifying the production of the plantations may be a solution for the Indonesian government to bridge the gap between the need for increased production and environmental conservation.

Currently, there is still a major gap in palm oil productivity between smallholder plantations and private company plantations. Therefore, the Indonesian government is prioritizing the oil palm intensification program for smallholder plantations. However, implementing an

intensification program for all smallholder plantations in Indonesia is a huge and costly undertaking. The designation of priority locations for intensification plays an important role in increasing program effectiveness and avoiding giving incentives to business actors whose plantation locations are not suitable for oil palm cultivation.

On the Publication

The function of this working paper is to identify the location of smallholder oil palm plantations possessing the potential to be prioritized for the intensification program through a holistic approach and methodology.

Currently, research on the selection of priority locations for oil palm plantations is still very limited. Therefore, this study departs from the study of Afriyanti *et al.* (2015) who conducted site selection based on biophysical and conservation aspects. By adding the aspect of economic potential, site selection in this study considers the biophysical aspects of the land, the existence of conservation areas, market access (palm oil mills), plantation areas, CPO productivity, and is supported by the best data from various publicly accessible sources, including Global Forest Watch, Transparent World, and the Directorate General of Plantations, Ministry of Agriculture.

Main Findings

The results of this study indicate that there are 499,399 hectares of smallholder oil palm plantations in 11 provinces and 23 districts in Indonesia that may be prioritized for the intensification program. These sites possess low productivity with suitable biophysical conditions for oil palm cultivation, in addition to being close to palm oil mills and located outside forest and peat areas.

The Indonesian government, in particular the Ministry of Agriculture, BPDPKS, and local governments, may apply the methodology and results of this study in planning intensification programs. Several programs to increase smallholder oil palm production being pushed by the government include oil palm rejuvenation programs, provision of plantation facilities and infrastructure, and the development of plantation areas.

Field checks and additional data are recommended for a more accurate location selection. Additional data such as the age of oil palm plantations, the distribution of plantation locations already possessing land ownership certificates, data on the capacity of palm oil mills, and other relevant data may be added according to the implementation needs of the intensification program adopted by stakeholders.

INTRODUCTION

Processed palm oil is easily found in the products we use every day, from food and cosmetics to cleaning agents and biofuels. Along with population growth, palm oil consumption continues to increase. In 2015, the world's use of palm oil reached 61.1 million tonnes, more than four times the volume recorded in 1995 at 14.6 million tonnes (European Palm Oil Alliance 2016). A study estimates that world palm oil demand will reach 264 million tonnes by 2050 (Afriyanti *et al.* 2016), or an increase of almost 300 percent from the current one (69.6 million tonnes) (Statista 2018). Indonesia, as the world's largest producer of palm oil, contributes to 60 percent (or approximately 41.9 million tonnes of CPO) of global production (GAPKI 2018a) and 14.03 million hectares of existing oil palm plantations (Jatmiko 2018). To stabilize the increase in world demand in the future, Indonesia is targeting a national palm oil production of 60 million tonnes per year by 2045 (Septiadi 2016).

Despite the various benefits of palm oil, the Indonesian palm oil industry is cited as one of the main causes of deforestation in tropical forests. In the space of 20 years, Indonesia has lost 2.3 million hectares of forests to land conversions into oil palm plantations (Austin *et al.* 2017). Without increased productivity, Indonesia would need an additional 6.1 million hectares of oil palm cultivation – almost the size of Sri Lanka – to achieve its national palm oil production target. This expansion will certainly increase the impacts on the environment, such as deforestation and peatland conversion.

The negative perceptions of palm oil and its derivatives in recent decades have also influenced international trade. For example, the European Union issued a Renewable Energy Guide (European Union Renewable Energy Directive II) to reduce carbon emissions produced by European Union countries by 2030, namely by targeting a reduction in non-renewable energy consumption, increasing the share of renewable energies, and determining the types of renewable energy and quality standards of renewable energy used. In this guide, the European Union labels palm oil as a high-risk commodity related to Indirect Land Use Change (ILUC). Palm oil is considered the largest contributor to greenhouse gas emissions, as its production involves the conversion of land with high carbon stocks (such as forests and peatlands). Implications of the risk label are the decline in the value of Indonesian palm oil exports to European Union countries (Khairunisa 2017). Only certain palm oil is permitted into these countries. Seeing these conditions, Indonesia must implement more environmentally friendly means to increase palm oil production.

In September 2018, the Indonesian government issued a moratorium on the use of forests for oil palm plantations to limit the expansion of new plantations. To continue increasing production, intensifying the production of existing plantations may be a solution. Intensification is an effort to increase production without requiring to expand cultivated lands. This may be carried out by implementing good agricultural practices (GAP) or rejuvenating less productive plantations. Considering the high disparity between the productivity of smallholder plantations and those of private companies, intensification may be one of the key efforts in increasing the productivity of smallholder plantations. Currently, smallholders manage about 40 percent (5.6 million hectares) of oil palm plantations in Indonesia (Junaedi 2018), with productivity nearly 50 percent lower than that of oil palm plantations owned by private companies (Soliman *et al.* 2016).

The intensification of all smallholder oil palm plantations in Indonesia is a huge and massively costly undertaking. Thus, it is important to determine the priority location for intensification to increase the effectiveness of the program and avoid giving incentives to business actors whose plantation locations are not suitable for cultivation.

To support the smallholder oil palm plantation intensification program run by the government and other stakeholders, WRI Indonesia proposes a methodology and tools that may be applied to identify priority locations for the intensification of smallholder plantations. Considering land suitability, conservation, and market access, this methodology focuses on smallholder plantations outside forest and peat areas. A similar study was conducted by Afriyanti *et al.* in 2015, by identifying three criteria, namely the biophysical condition of the land, the type of land use, and the existence of a moratorium and conservation area. The results of this study indicate that there are 17 million to 26 million hectares of land with the potential for intensification. However, this figure is still a rough estimate and does not indicate the exact locations of the required oil palm plantations.

The WRI Indonesia study refers to the best data from various sources accessible to the public at the time of the study, namely data from Global Forest Watch, Transparent World, and the Directorate General of Plantations, Ministry of Agriculture. The focus of the study is to select priority intensification sites using a similar methodology applied by Afriyanti by adding a self-developed scoring system. In addition, WRI Indonesia also applies additional data, such as the distribution of smallholder oil palm plantations, the productivity of smallholder plantations, and the distribution of palm oil mills. In the process of developing the methodology, WRI Indonesia received input from relevant stakeholders, including the government, private

companies, academics, and non-governmental organizations (NGOs). The results of this study are expected to be a reference and a source of consideration for stakeholders in efficiently implementing the smallholder oil palm plantation intensification program.

METHODOLOGY

For the first step, this study identifies the variables influencing the success of intensification. The selection of variables applied in this analysis utilizes four main considerations, namely practicality (availability of data to the public), direct impact on productivity, protection of forest and peatland ecosystems,

and potential market access to sell intensified fresh fruit bunches (FFB). The variables used in this study consist of:

- Land suitability for oil palm cultivation;
- Map of smallholder oil palm plantations;
- The productivity of smallholder oil palm plantations;
- Distribution of conservation areas, such as the presence of forests, riparian zones, and peatlands;
- Land legality; and
- Market access potential, expressed in terms of distance to palm oil processing mills (PKS).

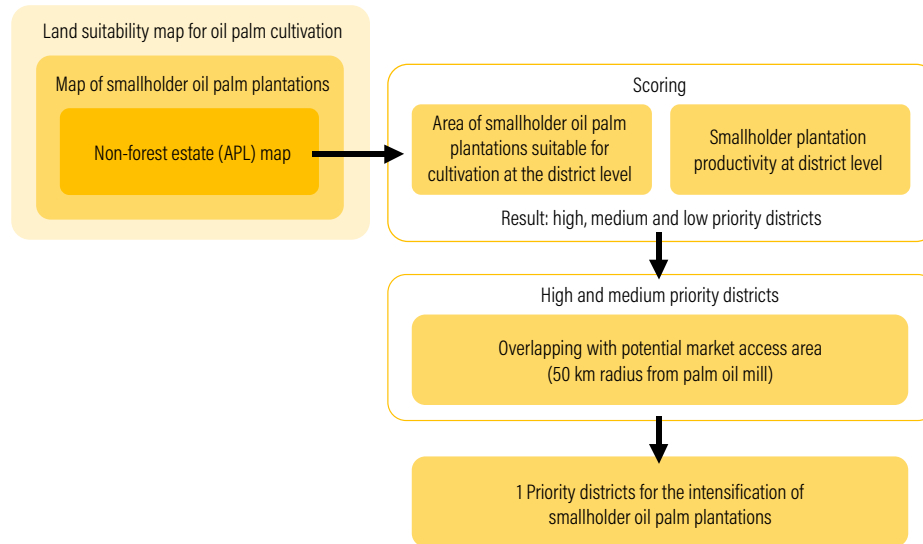
Table 1 | Data Sources for Analysis

NAME	DESCRIPTION	SOURCE	RESOLUTION	TIME
Land suitability map for oil palm	Suitable locations for oil palm cultivation are selected based on land suitability indicators taking into account biophysical and conservation aspects.	WRI	1:250.000	2012
Link: https://www.globalforestwatch.org/				
Map of smallholder oil palm plantations	Distribution of smallholder oil palm plantations from the results of satellite image processing.	WRI and Transparent World	30 m x 30 m	2013-2014
Statistical data on the productivity of smallholder oil palm plantations	Data on smallholder plantation productivity at the provincial and district levels.	Directorate General of Plantations, Ministry of Agriculture		2015
Link: http://ditjenbun.pertanian.go.id/tinymcpuk/gambar/file/statistik/2017/Kelapa-Sawit-2015-2017.pdf				
Non-Forest Estate (APL) map.	Map showing non-forest areas designated as Non-Forest Estate (APL)	Ministry of Environment and Forestry	1:250.000	2017
Map of palm oil mills distribution	The map of the distribution of palm oil mills in Indonesia was formulated to identify areas of potential market access for smallholders to sell intensified FFB. The definition of a potential market access area is an area within a radius of 50 km from the center of the mill.	WRI dan FoodReg	Data point	2015

Link: <https://www.globalforestwatch.org>

The use of each variable and methodology flow for determining priority locations for the intensification of smallholder oil palm plantations are summarized within Figure 1. In the process of developing this methodology, WRI Indonesia also consulted with selected resource persons from the Ministry of Agriculture, the Oil Palm Plantation Fund Management Agency (BPDPKS), Riau Province Plantation Agency, Siak District Agricultural Agency, Indonesian Palm Oil Research Institute (PPKS), representatives of oil palm plantation companies, academics from universities (Bogor Agricultural University and Riau University), and non-

governmental organizations (Roundtable on Sustainable Palm Oil – RSPO), Kehati, and Lingkar Temu Kabupaten Lestari) through focus group discussions (FGD). The input obtained from these discussions include: 1) additional criteria to be considered in the selection of intensification priority sites, 2) identifying the challenges of intensifying smallholder plantations, 3) smallholder farmers’ perspective of the intensification program, and 4) the potential utilization of the results of research on intensification priority locations in the regions.

Figure 1 | Process of Designating Priority Locations for the Intensification of Smallholder Oil Palm Plantations

Source: Author Illustration

The land suitability map for oil palm cultivation was obtained from the Global Forest Watch (GFW) platform developed by WRI. This platform possesses a feature to allow users to identify potential locations for oil palm cultivation outside of forest and peat cover on the four main palm oil producing islands, namely Sumatra, Kalimantan, Sulawesi, and Papua. This feature is an extension of the POTICO Project carried out by WRI and Sekala in 2012 with Kalimantan as a pilot location.

Suitable sites for oil palm cultivation are selected based on land suitability indicators taking into account biophysical and conservation criteria. Biophysical criteria are designed to determine areas suitable for oil palm growth. This criterion consists of six indicators, namely (Table 2): (1) elevation, (2) rainfall, (3) soil depth, (4) soil type, (5) soil drainage, and (6) soil acidity. These indicators are important economic factors influencing fruit production, the amount and type of management required for agricultural input (e.g. fertilizers, irrigation, terracing), and the long-term profitability of a plantation (Gingold 2012).

Table 2 | Biophysical Indicators for the Suitability of Oil Palm Cultivation

BIOPHYSICAL INDICATORS	SUITABLE	UNSUITABLE
Elevation (m)	0 – 400	> 400
Rainfall (mm/year)	1,250 – 6,000	> 6,000; < 1,250
Soil Depth (cm)	> 51	≤ 50
Soil Type	Inceptisol, oxisol, alfisol, ultisol, spodosol, entisol	Histosol
Soil Drainage	Well-drained, moderately well-drained, excessively drained, poorly drained	Excessively drained, very poorly drained, stagnant
Soil Acidity	≤ 7.3	> 7.3

Source: Gingold et al. 2012

Conservation criteria are designed to determine the site's suitability for plantation development based on the carbon stock value, high conservation values (HCV 1-3), and soil and water protection. These criteria are adopted from the principles and standards of good plantation management that have been widely accepted by sustainable palm oil certification systems, such as the Indonesian Sustainable Palm Oil (ISPO), RSPO, and other

trade commitments. Conservation criteria must always be put into consideration to ensure that plantation products possess the capability to strongly compete in the international market. There are five indicators of conformity to this criterion, namely (Table 3): (1) land cover, (2) peat, (3) slope, (4) conservation buffer zone, and (5) riparian buffer zone (Gingold 2012).

Table 3 | Conservation Indicators on Land Suitability for Oil Palm Cultivation

CONSERVATION INDICATOR	SUITABLE	UNSUITABLE
Land cover	Grasslands, shrubs, plantations, agriculture, settlements/ non-forest areas (outside the forest)	Primary forests, secondary forests, wetland
Peat (cm)	0	All scores > 0
Slope (%)	0 – 30	> 30
Conservation buffer zone (m)	> 1000	< 1000
Riparian buffer zone (m)	> 100	< 100

Source: Gingold et al. 2012

Considering that data on the productivity of smallholder oil palm plantations is currently only available at the district level, the identification of priority locations for intensification is thus carried out at the district level. The identification process is conducted by utilizing spatial analysis and a scoring system. A map of land suitability for oil palm cultivation is superimposed with maps of smallholder oil palm plantation distribution and maps of district administrations to produce data on “area of smallholder oil palm plantations suitable for cultivation” at the district level. Furthermore, this data and the data on “smallholder plantation productivity” are divided into five priority categories, namely very low, low, medium, high, and very high (Table 4), and assigned a score. The division of this category is based on the class interval formula. Distribution tests for data on “area of smallholder oil palm plantations suitable for cultivation” and “productivity of smallholder plantations” were conducted to ensure that there was no bias in data categorization. The results of the distribution test show that the data on “smallholder plantation productivity” is normally distributed and the data on “the area of smallholder oil palm plantations suitable for cultivation” is skewed to the

left. However, the data on “the area of smallholder oil palm plantations suitable for cultivation” may not be processed (by discarding some of the data) into normally distributed data because all these data are important and must be taken into account in the analysis.

A district is considered to have a high priority for intensification if it possesses large smallholder oil palm plantation areas suitable for cultivation and low productivity. Thus, the highest score was given to the district with the largest plantation areas suitable for cultivation and the district with the lowest plantation productivity (Table 5). The two scores from each data are then added together to obtain a total score. The total score in each district is then divided into three priority categories (low, medium, and high). An illustration of the calculation of the score may be seen in Table 6 and the calculation results for all districts may be seen in Appendix 1.

Category interval = $\frac{Max\ data\ score - Min\ data\ score}{number\ of\ categories(5)}$

Table 4 | Determining Lower Limit and Upper Limit of Each Category

PRIORITY CATEGORY	LIMIT	EQUATION
Very Low	Lower limit	Min data score
	Upper limit	Min data score + category interval
Low	Lower limit	Upper limit of “very low” + 1
	Upper limit	Lower limit of “low” + category interval
Medium	Lower limit	Upper limit of “low” + 1
	Upper limit	Lower limit of “medium” + category interval
High	Lower limit	Upper limit of “medium” + 1
	Upper limit	Lower limit of “high” + category interval
Very High	Lower limit	Upper limit of “high” + 1
	Upper limit	Lower limit of “very high” + category interval

Source: Author Illustration

Table 5 | **Score for Each Category**

PRIORITY CATEGORY	SCORE	
	SIZE OF SMALLHOLDER OIL PALM PLANTATION SUITABLE FOR CULTIVATION	SMALLHOLDER PLANTATION PRODUCTIVITY
Very Low	1	5
Low	2	4
Medium	3	3
High	4	2
Very High	5	1

Source: Author Illustration

Table 6 | **Illustration of Priority Scale Designation Calculation**

PROVINCE	DISTRICT	SIZE (HA)	PRODUCTIVITY (KG/HA)	SIZE (HA)	PRODUCTIVITY SCORE (KG/HA)	TOTAL SCORE	PRIORITY
Jambi	Bungo	180,712	3,248	5	3	8	High
Jambi	Tanjung Jabung Timur	79,684	1,982	3	4	7	Medium
Aceh	Southwest Aceh	1,155	1,401	1	5	6	Medium
West Sumatra	Agam	55,162	2,495	2	4	6	Medium
South Sumatra	Banyuasin	7,988	1,616	1	5	6	Medium
Central Kalimantan	East Barito	463	1,569	1	5	6	Medium
Aceh	Bireun	12,799	1,296	1	5	6	Medium
Southeast Sulawesi	Konawe	3,178	1,323	1	5	6	Medium
Southeast Sulawesi	South Konawe	604	1,000	1	5	6	Medium
Southeast Sulawesi	North Konawe	163	1,188	1	5	6	Medium
North Sumatra	Serdang Bedagai	17,292	3,368	1	2	3	Low
North Sumatra	Simalungun	3,754	3,359	1	2	3	Low

Source: Author Illustration

Harvested FFB must be processed immediately within 24 hours to maintain the quality of the palm oil produced. Thus, the longest possible plantation distance for such processing is around 50 km (Lake *et al.* 2016). *Considering this fact, maps of smallholder* oil palm plantations suitable for cultivation at the district level falling into the “medium” and “high” priority categories must be superimposed with a map of potential market access areas. From here, potential locations will be identified, which may then be prioritized for smallholder oil palm plantation intensification programs.

RESULTS

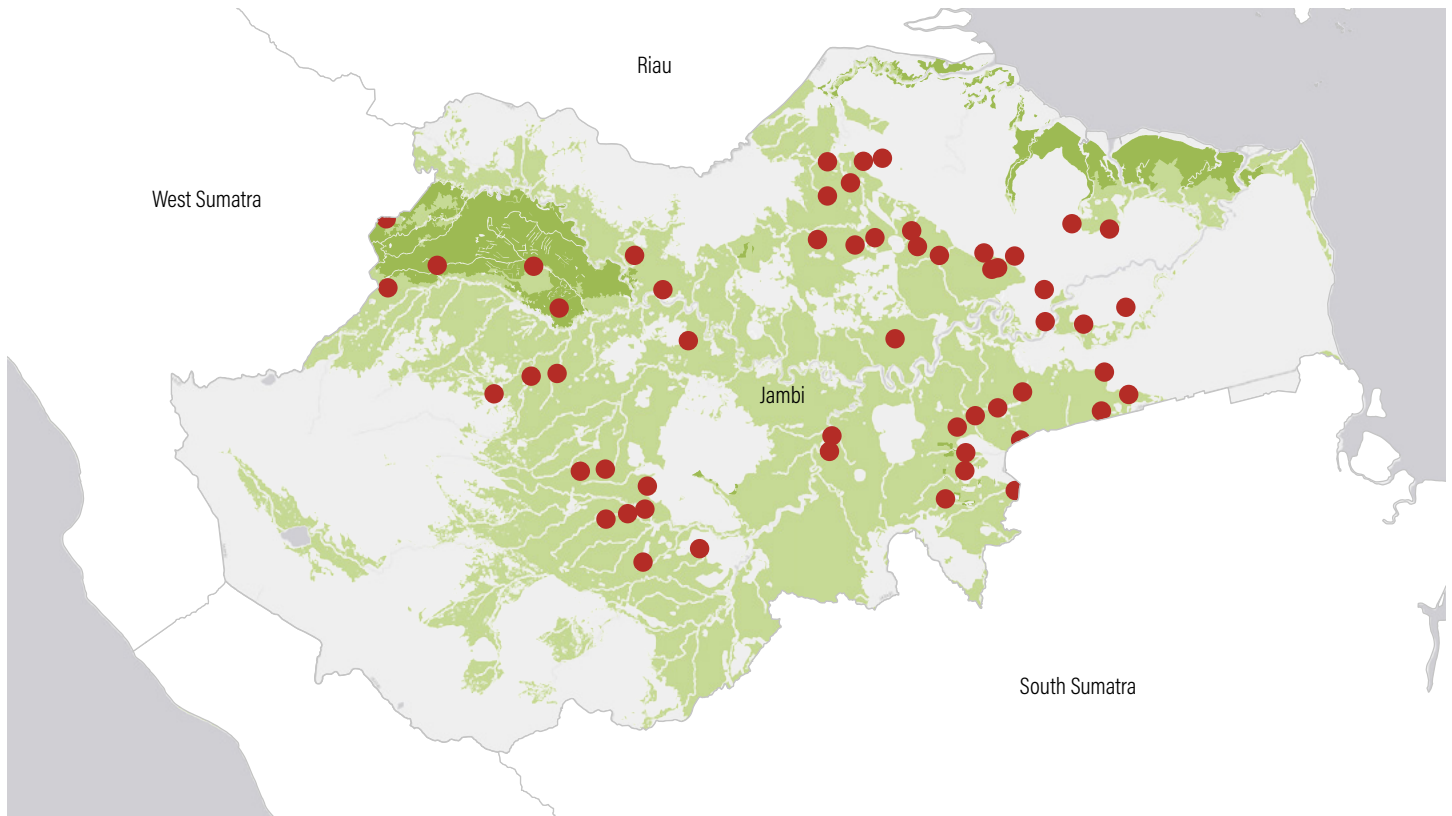
The results of the study show that Indonesia has 499,399 hectares of smallholder oil palm plantations in 11 provinces and 23 districts with low productivity but are suitable for palm oil cultivation, which means they are located outside forest and peat areas and close to palm oil mills (Table 7). We recommend that these locations be prioritized for the intensification program. An example of an oil palm plantation at the provincial and district levels is shown in Figure 2.

Table 7 | **Provinces and Districts That May Be Prioritized for the Smallholder Oil Palm Plantation Intensification Program**

PROVINCE/DISTRICT	PRIORITIZED SMALLHOLDER OIL PALM PLANTATION SIZE (HA)
Jambi	257,064
Bungo	178,303
East Tanjung Jabung	77,944
Sarolangun	818
Riau	85,712
Bengkalis	46,900
Rokan Hulu	25,775
Kampar	13,037
West Kalimantan	74,043
Sambas	57,267
Kubu Raya	9,767
Bengkayang	5,240
Sanggau	1,148
Singkawang	361
Landak	261
West Sumatra	50,980
Agam	50,980
Aceh	14,173
Bireuen	12,631
Southwest Aceh	1,139
East Aceh	403
South Sumatra	7,882
Banyuasin	7,882
East Kalimantan	5,270
North Penajam Paser	5,270
South Kalimantan	2,768
Tanah Laut	2,768
Southeast Sulawesi	854
Konawe	693
North Konawe	161
Central Kalimantan	457
East Barito	457
Lampung	195
Pringsewu	195
Total (Ha)	499,399

Source: Author Analysis Results

Figure 2 | **Examples of Smallholder Oil Palm Plantation Locations That May Be Prioritized for Intensification Program**

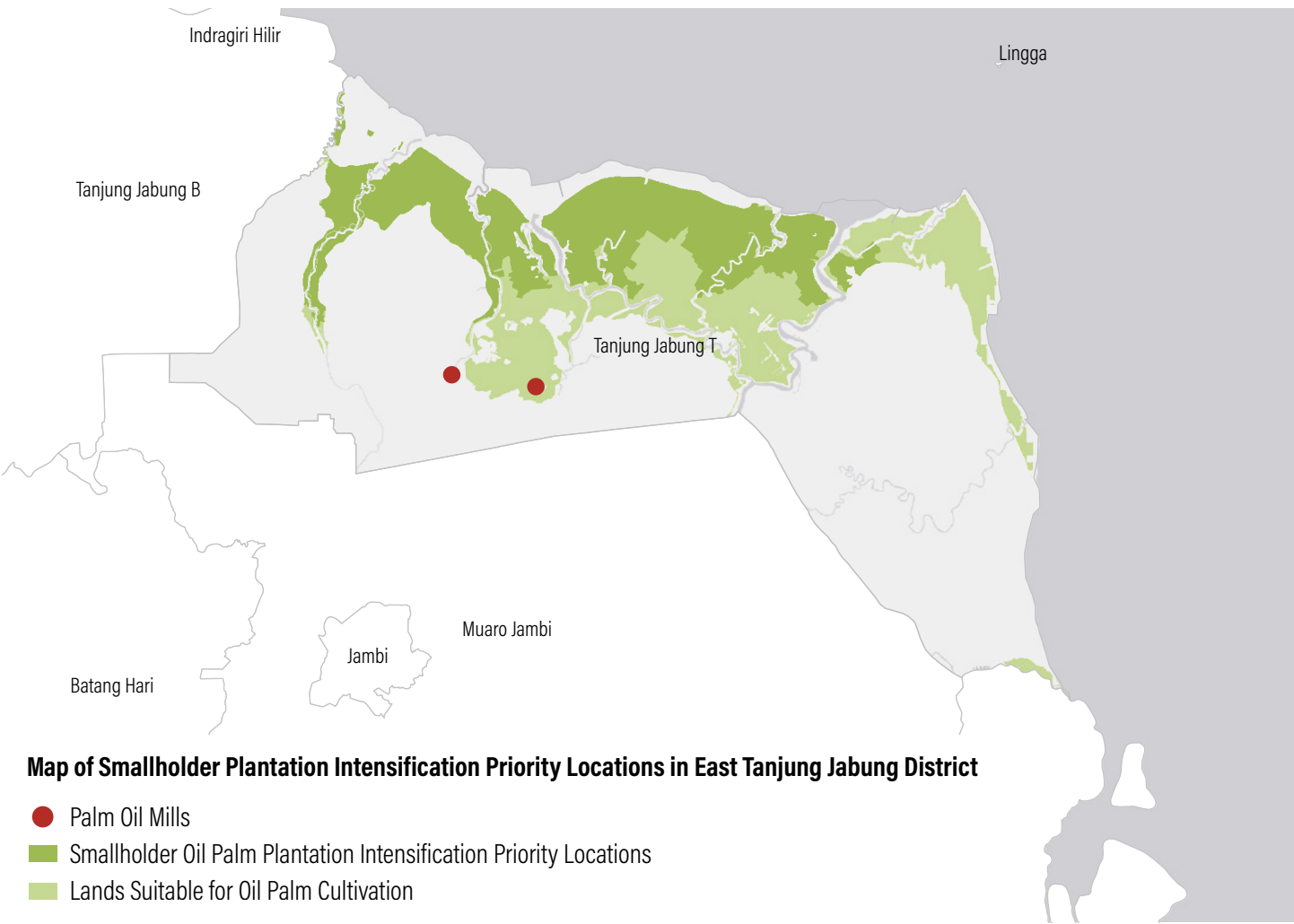


Map of Smallholder Plantation Intensification Priority Locations in Jambi Province

- Palm Oil Mills
- Smallholder Oil Palm Plantation Intensification Priority Locations
- Lands Suitable for Oil Palm Cultivation

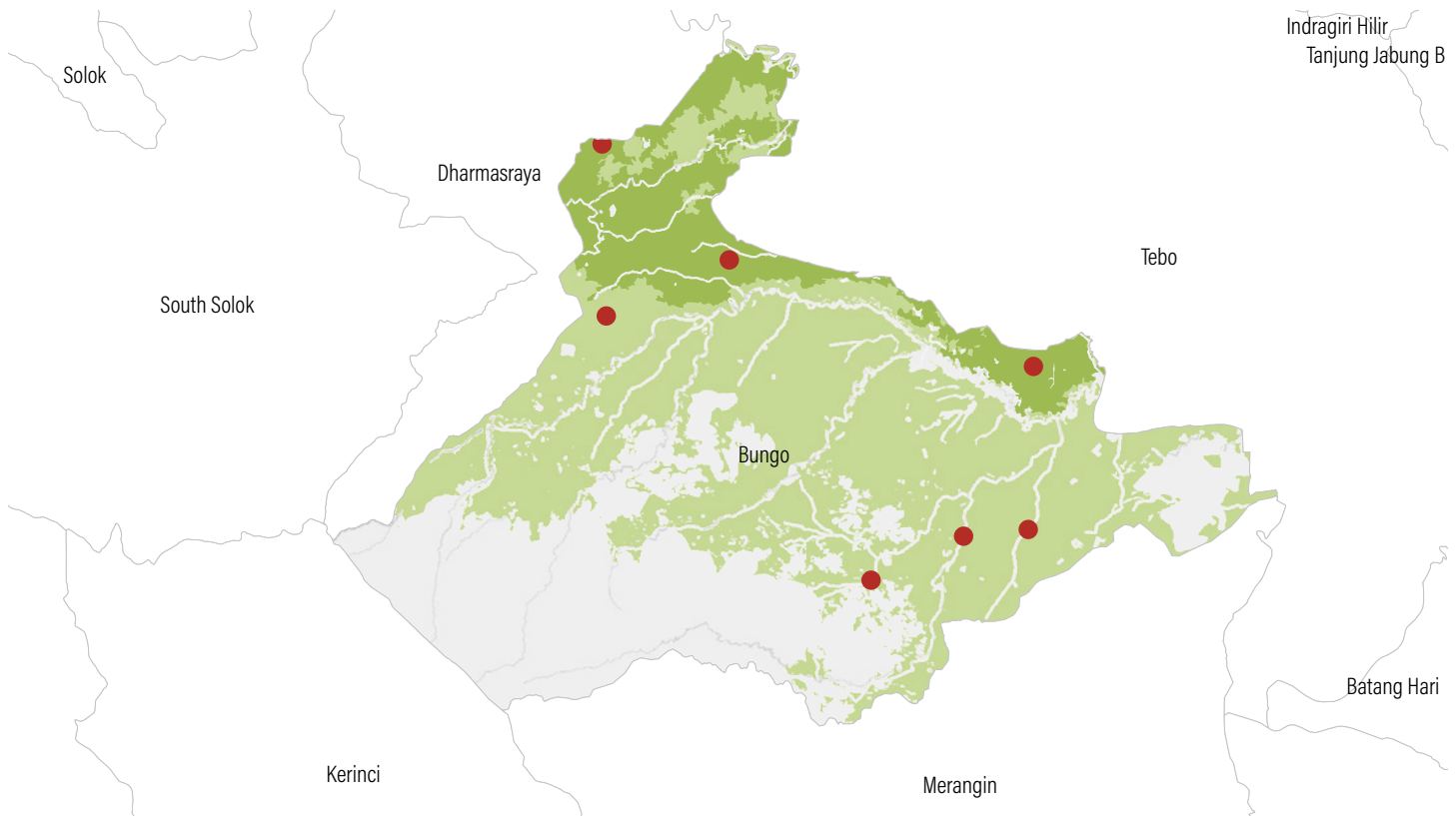
Source: Author Analysis Results

Figure 2 | Examples of Smallholder Oil Palm Plantation Locations That May Be Prioritized for Intensification Program (Cont'd)



Source: Author Analysis Results

Figure 2 | Examples of Smallholder Oil Palm Plantation Locations That May Be Prioritized for Intensification Program (Cont'd)



Map of Smallholder Plantation Intensification Priority Locations in Bungo District

- Palm Oil Mills
- Smallholder Oil Palm Plantation Intensification Priority Locations
- Lands Suitable for Oil Palm Cultivation

Source: Author Analysis Results

IMPLEMENTATION OPPORTUNITY

The methodology and results of this analysis may be utilized by the Ministry of Agriculture, the BPDPKS, and local governments to formulate policies for selecting locations for smallholder oil palm plantation intensification programs, as well as for budget funds and programs to run more effectively and on target. Several examples of previously implemented government programs include:

Smallholder Oil Palm Rejuvenation

The rejuvenation of smallholder oil palm plantations has been the government's focus since 2017 to improve governance of Indonesian oil palm plantations and increase the productivity of smallholder plantations. The rejuvenation program is considered important because 2.4 million hectares of the 5.6 million hectares of smallholder plantations are currently deemed less productive (Sawit Plus 2018). Of the 2.4 million hectares of plantations, 2.1 million hectares are indicated to be young plantations (less than 25 years old) that use low-quality seeds, while the remaining 300,000 hectares are old plantations (more than 25 years old) that are no longer productive (Kumparan 2018). Both are the main causes behind the low productivity of smallholder oil palm plantations in Indonesia.

The implementation of the smallholder oil palm rejuvenation program is regulated by the government through the Decree of the Director General of Plantations No. 29/2017 and No. 240/2018. The Directorate General of Plantations, Ministry of Agriculture defines oil palm rejuvenation as an effort to develop plantations by replacing old plants that have surpassed their economic life of 25 years; have a productivity of less than 10 tonnes of FFB per hectare per year at a minimum age of 7 years; or use non-certified seeds, with certified, high-quality plants. By using certified plants, the productivity of smallholder plantations are expected to increase, as they would be using superior seeds whose quality has been guaranteed by the government.

Several institutions playing a role in implementing the rejuvenation program are the Ministry of Agriculture, the BPDPKS, and the Plantation Agencies at the provincial and district levels. The Ministry of Agriculture is tasked with making and establishing roadmaps for rejuvenation activities, establishing regulations regarding rejuvenation guidelines within the BPDPKS funding framework, and providing technical recommendations in the process of distributing palm oil funds for rejuvenation activities. Meanwhile, the BPDPKS functions to distribute the allocation of rejuvenation funds sourced from export levies and contributions from oil palm plantation business actors brought together and managed by the BPDPKS. At the provincial and district levels, the Plantation Agencies play a role

in promoting the rejuvenation program, collecting and verifying data on smallholders, as well as making and verifying technical recommendations for rejuvenation proposals to be submitted to the Ministry of Agriculture.

The oil palm rejuvenation program is done by assisting in the rejuvenation costs of smallholders to the amount of Rp 25 million per hectare with a maximum of 4 hectares of plantation for each family head (KK). The rejuvenation component financed by the BPDPKS includes operational costs for preparations, rejuvenation costs, and human resource development. Broadly speaking, the operational costs for preparing rejuvenation include administrative preparations (for example, making plantation maps and complete legal certificates) and establishing smallholders' organizations. The cost of rejuvenation includes the cost of land preparation and procurement of certified seeds, fertilizers, pesticides, agricultural tools, and the necessary infrastructure. The cost of developing human resources, which consists of assistance and facilitation costs for smallholders, aims to increase the capacity of smallholders in rejuvenating and managing plantations to make them more productive and environmentally friendly.

Smallholder oil palm rejuvenation is carried out in 20 priority provinces and is targeted for completion by 2022 (BPDPKS 2018a). In 2017, the government targeted the rejuvenation of 20,780 hectares of plantations (GAPKI 2018b), followed by an additional 185,000 hectares in 2018 (Laoli 2018). However, by the end of 2018, the rejuvenation efforts only reached 14,264 hectares spread across seven provinces, namely South Sumatra, North Sumatra, Jambi, Riau, Bengkulu, Central Kalimantan, and East Kalimantan. The delay in achieving the target of rejuvenation was caused by, among other factors, the slow process of smallholder data administration and verification, high number of land legality problems (for example, plantations in forest areas, owners do not possess land ownership certificates, etc.), and various other operational obstacles in the field, such as seed readiness, disbursement of funds, and smallholder institutions preparedness (Amri 2018).

The methodology and results of the analysis of priority provinces and districts for the smallholder plantation intensification program in this study may be applied as material for consideration by the government, particularly the Plantation Agencies at the district levels in formulating technical recommendations for rejuvenation proposals to be submitted to the provincial level Plantation Agencies and the Ministry of Agriculture. With the results of this analysis, district and provincial governments may directly focus the rejuvenation program on the identified locations and conduct field checks to determine the location of rejuvenation at the site level.

Box 1 | Smallholder Oil Palm Plantation Rejuvenation Program Priority Provinces

- | | |
|--------------------|-----------------------|
| 1. Aceh | 11. West Kalimantan |
| 2. North Sumatra | 12. Centrl Kalimantan |
| 3. West Sumatra | 13. North Kalimantan |
| 4. Riau | 14. South Kalimantan |
| 5. Jambi | 15. East Kalimantan |
| 6. South Sumatra | 16. South Sulawesi |
| 7. Bangka Belitung | 17. Central Sulawesi |
| 8. Bengkulu | 18. West Sulawesi |
| 9. Lampung | 19. Papua |
| 10. Banten | 20. West Papua |

Source: BPDPKS 2018c

Provision of Smallholder Oil Palm Plantation Facilities and Infrastructure

The provision of supporting facilities and infrastructure for smallholder oil palm plantations is a program of the Ministry of Agriculture, with the BPDPKS as the institution assigned to manage and distribute program funds. This program aims to increase the production, productivity, and the quality of FFB of smallholder plantations by distributing assistance in the form of funds, goods, and/or services to smallholder groups or other institutions approved by the government. Assistance may be used to purchase seeds, fertilizers, pesticides, post-harvest equipment, as well as product processing, to construct plantation roads and access to public roads and/or ports, and purchase or rent transportation equipment and agricultural machinery.

The mechanism for distributing funds for oil palm plantation facilities and infrastructure is regulated under Finance Ministerial Regulation No. 49/2018. The Directorate General of Plantations and the BPDPKS have the authority to determine priorities and budget allocations and formulate technical recommendations for proposals for receiving BPDPKS funds. In addition, the BPDPKS also plays a role in monitoring and evaluating the use of facilities and infrastructure funds on a regular basis.

Regarding site selection, the BPDPKS mandates that the distribution of program assistance for the provision of facilities and infrastructure for smallholder plantations focus on areas in need of appropriate biophysical and climatic requirements for oil palm cultivation (BPDPKS 2018b). Thus, the results of the analysis of priority provinces and districts for smallholder oil palm plantation intensification programs may be utilized by the Ministry of Agriculture and the BPDPKS in determining the locations that are the main targets for the distribution of funds for oil palm plantation facilities and infrastructure.

Plantation Area Development

Another effort made by the Directorate General of Plantations, Ministry of Agriculture to increase the productivity of plantations is implementing a policy aimed at developing plantation areas as a center for plantation development through a regional suitability approach. Locations designated as plantation areas may be in the form of existing areas and new locations in accordance with the typology of agroecosystems and the requirements for commodity cultivation according to Agriculture Ministerial Regulation No. 56/2016. The policy for developing plantation areas is expected to tackle unproductive land use and become the basis for the formulation of commodity development zoning, or agricultural spatial planning focused on land compatibility (Directorate General of Plantations, 2014).

Types of commodities and priority locations for plantation commodity-based area development programs are regulated under Agriculture Ministerial Decree No. 830/2016 on National Agricultural Area Development Locations. Under this regulation, the government stipulates 11 plantation commodities, as well as priority locations for the development of each commodity. The 11 commodities are sugar cane, coffee, tea, cocoa, cashew, pepper, cloves, nutmeg, palm oil, rubber, and coconut. Specifically for palm oil commodities, the location for developing commodity areas is directed to 34 districts in nine provinces of Indonesia.

Box 2 | Locations of National Agricultural Area Development – Priority Commodity: Palm Oil Plantation according to Ministry of Agriculture Decree No. 830/2016

PROVINCE	DISTRICT
Aceh	Nagan Raya, Aceh Singkil
West Sumatra	West Pasaman, Dharmasraya, South Solok, South Pesisir
Riau	Bengkalis, Dumai City, Rokan Hilir, Rokan Hulu, Kampar, Siak, Pelalawan
South Sumatra	Muara Enim, Ogan Komering Ilir, Musi Banyuasin, Banyuasin
Bengkulu	Bengkulu Utara, Muko-Muko, Central Bengkulu, Seluma, South Bengkulu, Kaur
Central Kalimantan	West Kotawaringin
South Kalimantan	Tanah Bumbu, Tanah Laut, Kotabaru
East Kalimantan	East Kutai, Kutai Kartanegara, Paser, Penajam North Paser
West Papua	Sorong, Teluk Bintuni, Manokwari

Source: Agriculture Ministerial Decree No. 830/2016

As a follow-up to the designation of the location for commodity-based area development, the Ministry of Agriculture issued Guidelines for the Development of Agricultural Areas regulated under Agriculture Ministerial Decree No. 56/2016. This guideline regulates the obligation of the plantation agency at the provincial level to prepare Masterplan documents as a technical reference in formulating plantation area developmental guidelines at the provincial level. Furthermore, the plantation agency at the district level is required to prepare an Action Plan for the development of plantation areas at the district level, which refers to the Masterplan formulated at the provincial level. This Action Plan document contains a detailed description of the Masterplan and identifies the location of the plantation area down to the subdistrict or village level.

The methodology and results of this study may be utilized by the plantation agencies at the provincial and district levels in preparing the Masterplan and Action Plan for Oil Palm Plantation Commodity-based Area Development, especially in identifying the existing locations of smallholder oil palm plantation areas with a high potential to be developed by local governments. Several provinces and districts designated by the government as national oil palm development areas are also priority locations for the smallholder oil palm plantation intensification program identified in this study, namely: the provinces of Riau (Bengkalis, Rokan Hulu, and Kampar districts), South Sumatra (Banyuasin), East Kalimantan (North Penajam Paser), and South Kalimantan (Tanah Laut).

STUDY LIMITATIONS

This study utilizes the best available data from various publicly accessible sources. Thus, the accuracy of the analysis results depends on the quality of the available data. The addition of data may also affect the ranking of intensification priority locations. We utilize data on the productivity of smallholder plantations in 2015 from the Directorate General of Plantations, Ministry of Agriculture. To obtain more accurate results, further studies may be conducted utilizing the latest data. Data on the distribution of palm oil mills used as the basis for determining market access areas do not represent all palm oil mills in Indonesia. The data also does not contain the production capacity of each mill, so it may not describe the potential number of intensified fruits that may be absorbed by the mills. Furthermore, determining market access will be more effective if each palm oil mill possesses traceability data on smallholder FFB supplied to the mill. Checking locations at the site level and adding other relevant data may certainly be utilized to select priority intensification locations more accurately according to the needs and policies adopted by stakeholders using this methodology. If more data becomes available to the public, this study is expected to utilize other supporting data sources in the future.

This study was designed to guide stakeholders, especially the Ministry of Agriculture and plantation agencies at the provincial and district levels, in selecting potential sites that may be prioritized for smallholder oil palm plantation intensification programs. However, the results of this study

do not suggest that the locations of non-priority smallholders do not require intensification. The intensification of smallholder plantations is still needed to optimize productivity, which in turn, may support increased community income, reduce the need for plantation expansion, and help achieve Indonesia's CPO production target by 2045.

CONCLUSION

This methodology is designed to provide guidance to the government and other relevant stakeholders in determining the location of smallholder oil palm plantations that may be prioritized for intensification programs. Site selection considerations in this methodology are based on several aspects, including the area of the plantation suitable for cultivation, plantation productivity, conservation, land legality, and potential access for FFB sales to palm oil mills. The results show that Indonesia has 499,399 hectares of smallholder plantations in 11 provinces and 23 districts with low productivity, but are in areas with biophysical conditions suitable for oil palm cultivation. In terms of location, these plantation areas are in reach of palm oil mills and are located outside of forest and peatland areas. Field checks as well as the modifications and/or addition of other relevant data must be conducted to obtain more accurate analysis results and in accordance with the intensification program targets.

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ATTACHMENT

Attachment 1 | Data Scoring Results of Sizes of Smallholder Oil Palm Plantations Suitable for Cultivation, Smallholder Plantation Productivity, and Ranking of Priority Districts for Intensification Program

NO.	PROVINCE	DISTRICT	SIZE (HA)	PRODUCTIVITY (KG/HA)	SCORE		TOTAL SCORE	PRIORITY
					SIZE (HA)	PRODUCTIVITY (KG/HA)		
1.	Jambi	Bungo	180,712	3,248	5	3	8	High
2.	Aceh	Southwest Aceh	1,155	1,401	1	5	6	Medium
3.	Aceh	South Aceh	2,445	2,202	1	4	5	Medium
4.	Aceh	East Aceh	408	2,162	1	4	5	Medium
5.	Aceh	Bireun	12,799	1,296	1	5	6	Medium
6.	Jambi	Sarolangun	829	2,361	1	4	5	Medium
7.	Jambi	East Tanjung Jabung	79,684	1,982	3	4	7	Medium
8.	West Kalimantan	Bengkayang	5,310	2,309	1	4	5	Medium
9.	West Kalimantan	Kubu Raya	9,899	1,722	1	5	6	Medium
10.	West Kalimantan	Landak	265	2,333	1	4	5	Medium
11.	West Kalimantan	Sambas	58,040	2,411	2	4	6	Medium
12.	West Kalimantan	Sanggau	1,164	2,387	1	4	5	Medium
13.	West Kalimantan	Singawang	366	1,503	1	5	6	Medium
14.	South Kalimantan	Tanah Laut	2,805	2,030	1	4	5	Medium
15.	Central Kalimantan	Barito Timur	463	1,569	1	5	6	Medium
16.	East Kalimantan	North Penajam Paser	5,342	2,000	1	4;	5	Medium
17.	Lampung	West Lampung	252	1,778	1	4	5	Medium
18.	Lampung	Pringsewu	197	2,244	1	4	5	Medium
19.	Riau	Bengkalis	47,739	2,858	2	3	5	Medium
20.	Riau	Kampar	13,213	2,047	1	4	5	Medium
21.	Riau	Rokan Hilir	47,723	3,275	2	3	5	Medium
22.	Southeast Sulawesi	Konawe	3,178	1,323	1	5	6	Medium
23.	Southeast Sulawesi	South Konawe	604	1,000	1	5	6	Medium
24.	Southeast Sulawesi	North Konawe	163	1,188	1	5	6	Medium
25.	West Sumatra	Agam	55,162	2,495	2	4	6	Medium
26.	South Sumatra	Banyuasin	7,988	1,616	1	5	6	Medium
27.	Aceh	West Aceh	579	3,503	1	2	3	Low
28.	Aceh	Aceh Singkil	6,751	3,453	1	2	3	Low
29.	Aceh	Aceh Tamiang	3,333	2,955	1	3	4	Low
30.	Aceh	North Aceh	547	3,899	1	2	3	Low
31.	Aceh	Nagan Raya	2,183	3,119	1	3	4	Low
32.	Bengkulu	North Bengkulu	538	3,524	1	2	3	Low
33.	Bengkulu	Mukomuko	1,088	3,631	1	2	3	Low
34.	Jambi	Batang Hari	495	3,634	1	2	3	Low
35.	Jambi	Muaro Jambi	1,346	2,583	1	3	4	Low

Attachment 1 | Data Scoring Results of Sizes of Smallholder Oil Palm Plantations Suitable for Cultivation, Smallholder Plantation Productivity, and Ranking of Priority Districts for Intensification Program (Cont'd)

NO.	PROVINCE	DISTRICT	SIZE (HA)	PRODUCTIVITY (KG/HA)	SCORE		TOTAL SCORE	PRIORITY
					SIZE (HA)	PRODUCTIVITY (KG/HA)		
36.	Jambi	West Tanjung Jabung	8,504	3,252	1	3	4	Low
37.	Jambi	Tebo	1,029	2,883	1	3	4	Low
38.	West Kalimantan	Sekadau	594	2,727	1	3	4	Low
39.	West Kalimantan	Sintang	1,471	2,990	1	3	4	Low
40.	South Kalimantan	Balangan	57,306	3,440	2	2	4	Low
41.	South Kalimantan	Barito Kuala	3,644	3,815	1	2	3	Low
42.	South Kalimantan	Tabalong	8,228	2,703	1	3	4	Low
43.	South Kalimantan	Tanah Bumbu	6,254	3,652	1	2	3	Low
44.	East Kalimantan	Berau	8,475	2,581	1	3	4	Low
45.	East Kalimantan	East Kutai	2,407	3,179	1	3	4	Low
46.	East Kalimantan	Paser	12,490	2,852	1	3	4	Low
47.	Lampung	Central Lampung	17,425	2,937	1	3	4	Low
48.	Papua	Keerom	10,501	2,688	1	3	4	Low
49.	West Papua	Manokwari	48	3,470	1	2	3	Low
50.	Riau	Dumai	12,542	3,270	1	3	4	Low
51.	Riau	Indragiri Hilir	50,048	3,336	2	2	4	Low
52.	Riau	Indragiri Hulu	3,175	3,683	1	2	3	Low
53.	Riau	Kuantan Singingi	169	2,714	1	3	4	Low
54.	Riau	Pelalawan	13,002	3,914	1	2	3	Low
55.	Riau	Rokan Hulu	26,123	3,969	1	2	3	Low
56.	Riau	Siak	14,099	3,449	1	2	3	Low
57.	West Sulawesi	Mamuju	1,088	2,991	1	3	4	Low
58.	West Sulawesi	North Mamuju	4,444	4,021	1	2	3	Low
59.	South Sulawesi	East Luwu	5,612	3,636	1	2	3	Low
60.	South Sulawesi	North Luwu	16,824	4,833	1	1	2	Low
61.	Central Sulawesi	Morowali	2,092	3,957	1	2	3	Low
62.	West Sumatra	Padang Pariaman	1,702	3,420	1	2	3	Low
63.	West Sumatra	West Pasaman	7,308	3,040	1	3	4	Low
64.	West Sumatra	South Pesisir	503	2,654	1	3	4	Low
65.	West Sumatra	Sijunjung	301	3,024	1	3	4	Low
66.	West Sumatra	Solok	673	3,000	1	3	4	Low
67.	South Sumatra	Lahat	1,080	3,443	1	2	3	Low
68.	South Sumatra	Muara Enim	1,138	3,645	1	2	3	Low
69.	South Sumatra	Musi Banyuasin	16,208	4,072	1	1	2	Low
70.	South Sumatra	Musi Rawas	102	3,355	1	2	3	Low
71.	South Sumatra	Ogan Ilir	785	2,891	1	3	4	Low
72.	North Sumatra	Asahan	15,137	3,721	1	2	3	Low

Attachment 1 | Data Scoring Results of Sizes of Smallholder Oil Palm Plantations Suitable for Cultivation, Smallholder Plantation Productivity, and Ranking of Priority Districts for Intensification Program (Cont'd)

NO.	PROVINCE	DISTRICT	SIZE (HA)	PRODUCTIVITY (KG/HA)	SCORE		TOTAL SCORE	PRIORITY
					SIZE (HA)	PRODUCTIVITY (KG/HA)		
73.	North Sumatra	Batu Bara	14,984	3,331	1	2	3	Low
74.	North Sumatra	Deli Serdang	22,172	3,691	1	2	3	Low
75.	North Sumatra	Labuhan Batu	7,463	3,277	1	3	4	Low
76.	North Sumatra	South Labuhan Batu	8,027	3,394	1	2	3	Low
77.	North Sumatra	North Labuhan Batu	1,668	3,077	1	3	4	Low
78.	North Sumatra	Langkat	27,836	3,403	1	2	3	Low
79.	North Sumatra	Mandailing Natal	5,089	3,856	1	2	3	Low
80.	North Sumatra	Padang Lawas	13,745	3,448	1	2	3	Low
81.	North Sumatra	North Padang Lawas	551	3,595	1	2	3	Low
82.	North Sumatra	Serdang Bedagai	17,292	3,368	1	2	3	Low
83.	North Sumatra	Simalungun	3,754	3,359	1	2	3	Low
84.	North Sumatra	South Tapanuli	95	3,761	1	2	3	Low

Source: Author Analysis Results

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Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

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We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

Our Approach

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to influence government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

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